

APPENDIX B



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Fecralloy™ Electrical Resistance Steel



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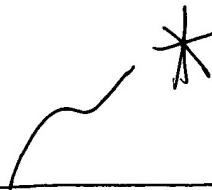
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Subcategory: Electronic/Magnetic Alloy; Ferrous Metal; Metal; Stainless Steel; Superalloy

Component Wt. %

Al	5.3
Cr	22
Fe	73



Material Notes:

Nominal iron content calculated as remainder. Yttrium addition does not appear in nominal composition. Ferritic stainless steel with aluminum. Available as wire, bar, tube, and strip. Used mainly for electrical elements in both industrial and domestic applications. Industrial applications vary from small laboratory kilns to heavy-duty heat-treatment furnaces under all types of atmospheres. "Fecralloy"** an Fe-Cr-Al steel containing "yttrium" is a versatile alloy and is suitable for use over a wide range up to 1300°C. The "yttrium" is the key to its longer high temperature life, having greater oxidation resistance and form stability over other resistance alloys.

***"Fecralloy" is the registered trademark of the UK Atomic Energy Authority (Now AEA Technology, Harwell). Information provided Resistalloy International Limited.

Physical Properties	Metric	English	Commercial
Density	7.15 g/cc	0.258 lb/in³	

Mechanical Properties

Hardness, Vickers	230	230	
Tensile Strength, Ultimate	750 MPa	109000 psi	
Tensile Strength, Ultimate at Elevated Temperature	37 MPa	5370 psi	900
Tensile Strength, Yield	550 MPa	79800 psi	
Elongation at Break	16 - 20 %	16 - 20 %	50 mm (2)

Electrical Properties

Electrical Resistivity	<u>0.000139 ohm-cm</u>	0.000139 ohm-cm	Temperature Factor is 1.05 at 800 (1470°F). Temperature Factor is 1.06 1000°C (1830°F). Temperature Factor is 1.06 at 1200°C (2190°
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Curie Temperature	<u>600 °C</u>	1110 °F
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Thermal Properties

CTE, linear 20°C	<u>11 µm/m-°C</u>	6.11 µin/in-°F	20-25C
CTE, linear 250°C	<u>11 µm/m-°C</u>	6.11 µin/in-°F	20-25C
CTE, linear 500°C	<u>12 µm/m-°C</u>	6.67 µin/in-°F	20-50C
CTE, linear 1000°C	<u>15 µm/m-°C</u>	8.33 µin/in-°F	20-100C
Specific Heat Capacity	<u>0.46 J/g-°C</u>	0.11 BTU/lb-°F	
Thermal Conductivity	<u>16 W/m-K</u>	111 BTU-in/hr-ft²-°F	
Melting Point	<u>1500 °C</u>	2730 °F	
Maximum Service Temperature, Air	<u>1400 °C</u>	2550 °F	

Optical Properties

Emissivity (0-1)	0.7	0.7	Fully Oxidized
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Some of the values displayed above may have been converted from their original units and/or rounded in order to display the information in a consistent format. Users requiring more precise data for scientific or engineering calculations can click on the property value to see the original value as well as raw conversions to equivalent units. We advise you only use the original value or one of its raw conversions in your calculations to minimize rounding error. We also ask that you refer to MatWeb's disclaimer and terms of use regarding this information. [Click here](#) to view all the property values for this datasheet as they were originally entered into MatWeb.

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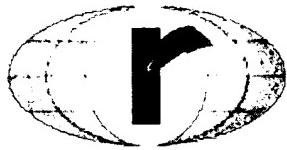
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RESISTALLOY

Resistalloy International Limited

Riverside Works, Weeton Street, Sheffield S9 2FT

Tel: (0114) 2448634 Fax: (0114) 2420902

Range of Resistance Heating Alloys (i)

PHYSICAL AND MECHANICAL PROPERTIES

P-C-Alloy 14% stainless steel (with aluminum)	FeCrAlloy	FeCrAlloy 14%	FeCrAlloy 13%	FeCrAlloy 13%
Form	Wire Strip Bar Tube	Wire Strip Bar	Wire Strip Bar	Wire Strip Bar
Maximum operating temperature: (elevation temperature in air) °C °F.....	1400 2550	1400 2550	1300 2370	1100 2010
Nominal composition % Cr.....	22	22	22	15
Al.....	5.3	5.8	4.8	4.3
Y.....	Addition	-	-	-
Fe.....	Bal	Bal	Bal	Bal
Density, g/cm³ lb/in³.....	7.15 0.259	7.10 0.256	7.25 0.262	7.28 0.263
Electrical resistivity at 20°C Ω mm²m⁻¹ at 68°F Ω /cmf.....	1.39 836	1.45 872	1.35 812	1.25 755
Temperature factor of the resistivity, C 600°C 1112°C.....	1.04	1.02	1.04	1.08
900°C 1470°C.....	1.05	1.03	1.06	1.10
1000°C 1830°C.....	1.06	1.04	1.07	1.11
1200°C 2190°C.....	1.06	1.04	1.08	-
Coefficient of thermal expansion, K⁻¹ 20 - 250°C 68 - 480°F.....	11. 10.6	11. 10.6	11. 10.6	11. 10.6
20 - 500°C 68 - 930°F.....	12. 10.6	12. 10.6	12. 10.6	12. 10.6
20 - 750°C 68 - 1380°F.....	14. 10.6	14. 10.6	14. 10.6	14. 10.6
20 - 1000°C 68 - 1830°F.....	15. 10.6	15. 10.6	15. 10.6	15. 10.6
Thermal conductivity at 20°C Wm⁻¹K⁻¹ 68°F Btu in ft⁻¹h⁻¹F.....	16. 111	16. 111	16. 111	16. 111
Specific heat capacity, kJ kg⁻¹K⁻¹ 20°C/ Btu lb⁻¹F⁻¹ 68°F.....	0.46 0.110	0.46 0.110	0.46 0.110	0.48 0.115
Melting point (approx.) °C °F.....	1500 2730	1500 2730	1500 2730	1500 2730
Mechanical properties** (approx.)				
Tensile strength, N/mm² tsi.....	750 48.5	750 48.5	750 48.5	750 48.5
Yield point, N/mm² tsi.....	550 35.5	550 35.5	550 35.5	550 35.5
Hardness (approx.) Hv.....	230	230	230	230
Elongation at failure (approx.) (on 50mm) %.....	16/20	16/20	16/20	16/20
Tensile strength at 900°C N/mm² 1650°F tsi.....	37 2.41	34 2.23	34 2.23	30 1.92
Creep strength at 800°C N/mm² at 1470°F tsi.....	8 0.52	6 0.39	6 0.39	4 0.26
at 1000°C N/mm² at 1830°F tsi.....	1.5 0.096	1 0.065	1 0.065	1 0.060
Magnetic properties.....	Magnetic (Curie point approx. 600°C 1100°F)			
Emissivity, E, fully oxidised condition....	0.70	0.70	0.70	0.70

* For maximum life of an element above 1300°C, Fecralloy 145 is recommended, due to the thicker oxide layer/higher aluminium content.

** Mechanical properties based on 2.0mm wire. Finer wire below 1.0mm will exhibit up to 10% higher tensile strength, and above 5.0mm diameter slightly lower strength.

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